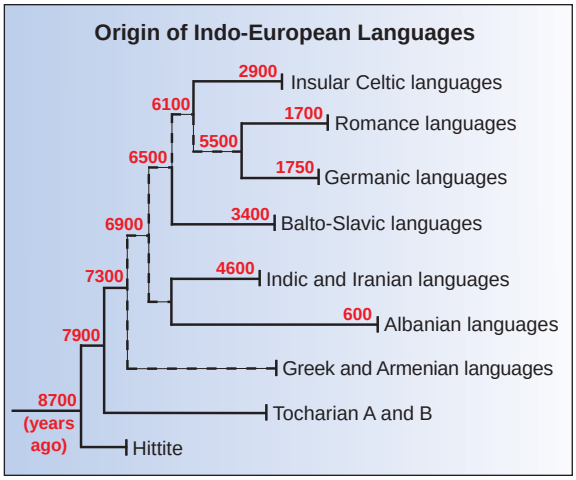
LINGUISTICS

Early Date for the Birth of Indo-European Languages

Ever since British jurist Sir William Jones noted in 1786 that there are marked similarities between diverse languages such as Greek, Sanskrit, and Celtic, linguists have assumed that most of the languages of Europe and the Indian subcontinent derive from a single ancient tongue. But researchers have fiercely debated just when and where this mother tongue was first spoken.



First words. A new study suggests that Indo-European languages arose 8700 years ago. Dotted lines indicate uncertainties.

Now a bold new study asserts that the common root of the 144 so-called Indo-European languages, which also include English and all the Germanic, Slavic, and Romance languages, is very ancient indeed. In this week's issue of *Nature*, evolutionary biologist Russell Gray and his graduate student Quentin Atkinson of the University of Auckland in New Zealand combine state-of-the-art computational methods from evolutionary biology with an older technique for dating languages, called glottochronology. Their results suggest that a proto–Indo-European tongue was spoken more than 8000 years ago by Neolithic farmers in Anatolia, in central Turkey; these farmers then spread it far and wide as they migrated from their homeland.

"It is almost too good to be true," says Margalit Finkelberg, a classicist at Tel Aviv University in Israel who has long favored this so-called Anatolian hypothesis. But many linguists prefer a competing theory, which traces Indo-European languages to Kurgan horsemen in southern Russia about 6000 years ago. Some of these researchers challenge the new methodology as well as its conclusions. "I cannot possibly accept [their] results," says linguist Craig Melchert of the University of North Carolina, Chapel Hill, who adds that the paper "simply reconfirms the unreliability of any glottochronological model, no matter what improvements are made."

Glottochronology uses the percentage of "cognates"—words with shared roots—to determine how long ago different languages diverged. For example, the Sanskrit and Latin words for "fire," *agnis* and *ignis*, show ▶

SOLAR PHYSICS

Polar Storms Reboot the Sun's Magnetic Program

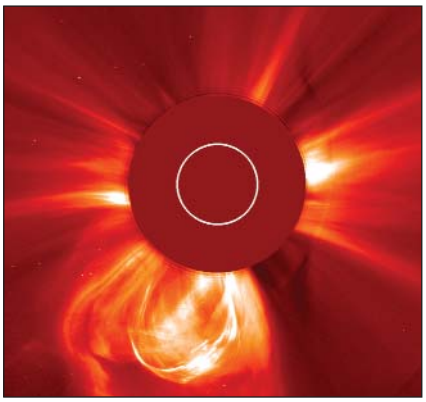
Our sun is a magnetic mess. Churning loops of charged gas continually roil its surface and atmosphere, especially when the sun nears the end of its 11-year cycle of flipping its magnetic field. Now, solar physicists have identified the key process that clears the way for freshly realigned magnetic fields to take root at the sun's poles: the titanic eruptions of gas called coronal mass ejections (CMEs).

A new study of thousands of CMEs reveals that the eruptions sweep away the stubborn remnants of old magnetic field at each pole. These high-latitude CMEs have no direct connection to the well-studied sunspots near the sun's equator, but they now appear more critical to understanding the sun's overall magnetic rhythms. "This is the first clear evidence that CMEs are related to the sun's polarity reversal," says solar theorist Boon Chye Low of the National Center for Atmospheric Research in Boulder, Colorado. "It's a very strong case."

The evidence comes from analysis of images taken by the Solar and Heliospheric Observatory (SOHO), which stares at the sun from a perch 1.5 million kilometers from Earth. A team led by solar physicist Nat Gopalswamy of NASA's Goddard Space Flight Center studied nearly 7000 CMEs caught by SOHO between 1996 and 2002. Most eruptions spewed from low and mid-latitudes, where sunspots mark the emergence of tangled magnetic fields. These active regions get most of the attention from scientists, because they can launch hazardous storms toward Earth.

In the 20 November *Astrophysical Journal Letters*, Gopalswamy's team focused on the 1200 CMEs that shot into space from latitudes greater than 60 degrees. Comparing the timing of the eruptions with ground-based records of magnetic field patterns at the poles, the researchers found a striking correlation. The polar eruptions climaxed for about 18 months as the field directions flip-flopped in chaotic fits and starts. But as soon as the new magnetic field was in place, the CMEs stopped. A similar pattern was evident in CMEs observed by a U.S. Air Force satellite from 1979 through 1985.

The team believes that each CME severs the bases of magnetic structures called polar crown filaments. A steady near-surface flow of electrically charged gas away from the equator pushes the magnetic field relentlessly toward the poles. Near the end of the 11-year cycle, the filaments crowd together like thickets of McDonald's golden arches, poking above the sun's surface into its atmosphere, or corona. Anchored to the sun, they form the last stand of the old magnetic alignment, until energetic CMEs rip them from the sun and expel billions of tons of charged gas from the corona. "CMEs remove the polar crown filaments," Gopalswamy says. "They stretch and change the magnetic field conformation in such a way that the polarity ultimately changes."



Thrown for a loop. A coronal mass ejection (bottom) severs the base of a magnetic arch and blasts the loop into space.

Low thinks the study will compel solar physicists to look at CMEs in a new light. "The focus has always been on individual eruptions," he notes. "This paper represents one of the first attempts to look at the collective effects of CMEs. They have a major global influence."

–ROBERT IRION

CREDITS: (TOP TO BOTTOM) AFTER GRAY AND ATKINSON, 2003; NASA/ESA